



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

WILLIAM J. AILA, JR.
CHAIRPERSON

WILLIAM D. BALFOUR, JR.
SUMNER ERDMAN
LORETTA J. FUDDY, A.C.S.W., M.P.H.
NEAL S. FUJIWARA
LAWRENCE H. MIIKE, M.D., J.D.
TED YAMAMURA

WILLIAM M. TAM
DEPUTY DIRECTOR

STAFF SUBMITTAL

COMMISSION ON WATER RESOURCE MANAGEMENT

June 21, 2012
Honolulu, Oahu

Advatage Webco
APPLICATION FOR A WATER USE PERMIT
Hawaii Raceway Park Well (Well No. 1906-07), TMK (1) 9-1-075:044, WUP No. 953
Future (irrigation) Use for 250 gpd
Malakole Ground Water Management Area, Oahu

APPLICANT:

Advatage Webco
2840 Mokumoa Street
Honolulu, HI 96819

LANDOWNER:

Same

SUMMARY OF REQUEST:

The applicant is requesting approval of a water use permit for an allocation of 250 gallons per day of non-potable caprock water from an existing well to irrigate 1 net acre of grass and hedges over 7 acres.

LOCATION MAP: See Exhibit 1

BACKGROUND:

Other pertinent background.

On April 2, 2012, the Commission on Water Resource Management (Commission) received a completed water use permit application from Advatage Webco. Additional information regarding the source, use, notification, objections, and field investigation(s) is provided in Attachment A.

ANALYSIS/ISSUES:

Section 174C-49(a) of the State Water Code establishes seven (7) criteria that must be met to obtain a water use permit. An analysis of the proposed permit in relation to these criteria follows:

(1) Water availability

Through the Hawaii Water Plan, the Commission has adopted 1,000 mg/l as the salinity limit for the Malakole Aquifer System Area. Individual existing water use permits in this aquifer system area are shown in Exhibit 2.

The water use permits shown in Exhibit 2 have been separated into two different categories – salt and non-salt water wells, as characterized by the water use permit database.

Salt-water wells are categorized as wells having salinity greater than 17,000 mg/l. The initial distinction is made with the salinity read after the well is drilled. However, pumpage should indicate the true nature of the well, as continued pumpage showing water in excess of the 17,000 mg/l will define its categorization as salt or non-salt water wells. It is apparent that monthly salinity reporting is needed to define these wells.

However, for the purpose of establishing water availability for this application, it is important to note trends in salinity of surrounding wells. Various wells show salinity for 2011 in the ranges of 8,000 mg/l to 18,791 mg/l, with no indication that salinity is increasing throughout the year.

Therefore, it appears that the resource can accommodate the requested allocation.

(2) Reasonable-beneficial

Section 174C-3 HRS defines "reasonable-beneficial use" is

"...the use of water in such a quantity as is necessary for economic and efficient utilization, for a purpose, and in a manner which is both reasonable and consistent with the state and county land use plans and the public interest".

I. Purpose of Use

The applicant is requesting the use of brackish, non-potable ground water for irrigation of 1 net acre of grass and hedges, which is considered irrigation use of water. The Declaration of Policy section, §174C-2(c) HRS, states that the Water Code shall be liberally interpreted to obtain maximum beneficial use of the waters of the State for various purposes including irrigation uses.

II. Quantity Justification

The applicant is requesting a total of 250 gallons per day for irrigation of 1 net acre of grass and shrubs.

Since its presentation to the Commission in April 2008, the Commission staff has used an ArcGIS based numerical simulation model, created in conjunction with the College of Tropical Agriculture and Human Resources (CTAHR), from the University of Hawaii, as a *guideline* to help review irrigation requirements for proposed water use permit applications. Most applications do not have the level of irrigation analysis as provided by this application. Nevertheless, it is useful to use the Irrigation Water Requirement Estimation Decision Support System (IWREDSS) model for comparative purposes.

A summary of the results of the model can be found in Exhibit 3. Based on this model, staff estimates that irrigation may be as high as 6,038 gallons per day per acre, based on an 80% rainfall event (i.e. 1 in 5 year drought event). Therefore, the applicant's request seems very low.

III. Efficiency of Use

The applicant states that its operations are as water efficient as possible because they will be using a new irrigation system consisting of some overhead sprinklers and some soakers, and they will irrigate in early morning and later afternoons.

IV. Analysis of Practical Alternatives

The applicant has identified addressed alternatives to the proposed use of brackish caprock water. An analysis of each of the alternatives is as follows:

1. Municipal sources – cost prohibitive
2. Wastewater reuse – none in the vicinity
3. Ditch system – none in the vicinity
4. Desalinization – not practical
5. Surface water – none in the vicinity

(3) Interference with other existing legal uses

There are 37 other wells within 1 mile of this source. Of these 37 wells, 8 are abandoned, 12 are unused, and 2 are observation wells. There are 15 production wells known to be in use. The pumpage from this well will be so small that any interference is highly unlikely.

(4) Public interest

Public interest is defined under §174C-2 - Declaration of policy, as follows:

“(c) The state water code shall be liberally interpreted to obtain maximum beneficial use of the waters of the State for purposes such as domestic uses, aquaculture uses, irrigation and other agricultural uses, power development, and commercial and industrial uses. However, adequate provision shall be made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation. Such objectives are declared to be in the public interest.”

Additionally, there have been no public comments or objections to this application.

Therefore, this application appears to be in the public interest.

(5) State & county general plans and land use designations

The proposed uses are in the State Urban District, and the county zoning is I-2. Therefore, the proposed use is consistent with these land use designations.

Normal agency review includes:

- 1) the State's Department of Land and Natural Resources (DLNR) and its State Parks, Aquatic Resources, Historic Preservation, and Land Divisions; the Department of Health (DOH) with its Clean Water, Safe Drinking Water, and Wastewater Branches; the Department of Hawaiian Home Lands (DDHL), and Land Use Commission (LUC); and the Office of Hawaiian Affairs (OHA).
- 2) the Office of the Mayor, Department of Planning and Permitting, Department of Planning, and the Board of Water Supply;

No comments or objections have been made through this review. These proposed uses are consistent with the state and county general plans and land use designations.

Therefore, this application meets the criteria for compliance with the state & county general plans and land use designations.

(6) County land use plans and policies

Again normal County review includes Office of the Mayor, Department of Planning and Permitting, and the Board of Water Supply. No comments or objections have been made.

Therefore, this application meets the criteria for compliance with the county land use plans and policies.

(7) Interference with Hawaiian home lands rights

All permits are subject to the prior rights of Hawaiian home lands. The Department of Hawaiian Home Lands (DHHL) and the Office of Hawaiian Affairs have reviewed this application. DHHL asked the Commission to adopt an interim policy for reservation of non-potable caprock water until the State Water Projects Plan is adopted that defines the water needs of DHHL. Standard water use permit conditions 3.g., 6., and 9.f. notify all water use permittees that their permits are subject to and cannot interfere with Hawaiian home land rights; therefore, these standard conditions should address DHHL comments.

Therefore, this application will not interfere with Hawaiian home lands rights.

(8) Other issues

I. Chapter 343 – Environmental Assessment (EA) Compliance

EA Triggers

In accordance with §HRS 343-5(a), the applicant's proposed action does not trigger the need for an EA.

RECOMMENDATION:


Staff recommends that the Commission approve the issuance of water use permit no. 953 to Advatage Webco for the reasonable and beneficial use of 250 gallons per day of brackish water for irrigation from the Hawaii Raceway Park Well (Well No. 1906-07), subject to the standard water use permit conditions listed in Attachment B and the following special conditions:

1. Should an alternate permanent source of water be found for this use, then the Commission reserves the right to revoke this permit, after a hearing.
2. In the event that the tax map key at the location of the water use is changed, the permittee shall notify the Commission in writing of the tax map key change within thirty (30) days after the permittee receives notice of the tax map key change.
3. Standard Condition 16 for a water shortage plan requirement is waived.
4. The permittee shall submit a contingency plan for water use in the event the chloride concentration in the permitted well(s) exceeds the 1,000 mg/l sustainable capacity limit

June 21, 2012

established for Ewa caprock aquifer sources, the permittee shall seek an alternative source of supply. The contingency plan shall be submitted to the Commission within 30 days of the issuance of this permit.

Respectfully submitted,

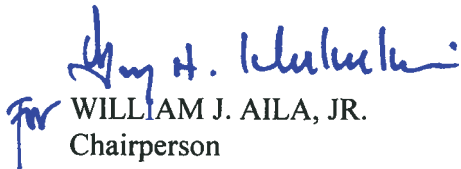


WILLIAM M. TAM
Deputy Director

Attachment(s): A (Water Use Permit Detailed Information)
 B (Water Use Permit Standard Conditions)

Exhibit(s): 1 (Location Map)
 2 (Existing Water Use Permits and Chloride Ranges)
 3 (IWREDDs calculations)

APPROVED FOR SUBMITTAL:



WILLIAM J. AILA, JR.
Chairperson

WATER USE PERMIT DETAILED INFORMATION**Source Information****AQUIFER:****Malakole System, Ewa Caprock Sector, Oahu**

Sustainable Yield: 1,000 mg/l

Existing Water Use Permits: 44.536 mgd

Available Allocation: n/a mgd

Total other pending applications: 0 mgd

This application: 250 gpd

WELL:**Hawaii Raceway Park Well (Well No. 1906-07)**

Location: 339 Kalaeloa Boulevard, Oahu, TMK: (1) 9-1-075:044

Year Drilled: 1957

Casing Diameter: 7 in.

Elevations (msl = 0 ft.)

Water Level: 1.3 ft.

Ground: 18 ft.

Bottom of Solid Casing: 15 ft.

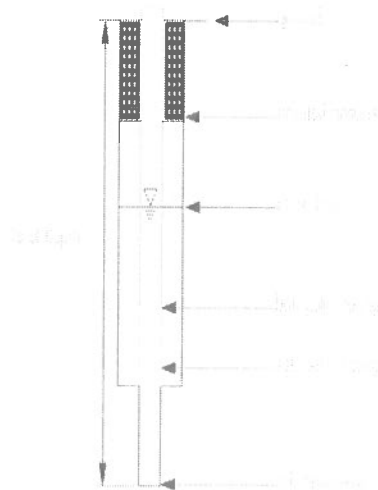
Bottom of Perforated: ? ft.

Bottom of Open Hole: -32 ft.

Total Depth: 50 ft.

Grouted Annulus Depth: unknown

Pump Capacity 200 gpm



ATTACHMENT A

Use Information

Quantity Requested:	0.001 mgd gallons per day.
Future Type of Water Use:	irrigation
Place of Water Use:	TMK: (1) 9-1-075: 044

Nearby Surrounding Wells and Other Registered Ground Water Use

There are 37 other wells within a mile of the well (see Exhibit 1). 15 of these wells are currently in use.

Public Notice

In accordance with HAR §13-171-17, a public notice was published in the Honolulu Star Advertiser on April 27, 2012 and May 4, 2012 and a copy of the notice was sent to the Office of the Mayor. Copies of the completed application were sent to the Department/Board of Water Supply, Department of Planning and Permitting, Department of Health, Department of Hawaiian Home Lands, Office of Hawaiian Affairs, the various divisions within the Department of Land and Natural Resources, and other interested parties for comments. Written comments and objections to the proposed permit were to be submitted to the Commission by May 18, 2012.

STANDARD WATER USE PERMIT CONDITIONS

1. The water described in this water use permit may only be taken from the location described and used for the reasonable beneficial use described at the location described above. Reasonable beneficial uses means "the use of water in such a quantity as is necessary for economic and efficient utilization which is both reasonable and consistent with State and County land use plans and the public interest." (HRS § 174C-3)
2. The right to use ground water is a shared use right.
3. The water use must at all times meet the requirements set forth in HRS § 174C-49(a), which means that it:
 - a. Can be accommodated with the available water source;
 - b. Is a reasonable-beneficial use as defined in HRS § 174C-3;
 - c. Will not interfere with any existing legal use of water;
 - d. Is consistent with the public interest;
 - e. Is consistent with State and County general plans and land use designations;
 - f. Is consistent with County land use plans and policies; and
 - g. Will not interfere with the rights of the Department of Hawaiian Home Lands as provided in section 221 of the Hawaiian Homes Commission Act and HRS § 174C-101(a).
4. The ground water use here must not interfere with surface or other ground water rights or reservations.
5. The ground water use here must not interfere with interim or permanent instream flow standards. If it does, then:
 - a. A separate water use permit for surface water must be obtained in the case an area is also designated as a surface water management area;
 - b. The interim or permanent instream flow standard, as applicable, must be amended.
6. The water use authorized here is subject to the requirements of the Hawaiian Homes Commission Act, as amended, if applicable.
7. The water use permit application and submittal, as amended, approved by the Commission at its June 21, 2012 meeting are incorporated into this permit by reference.
8. Any modification of the permit terms, conditions, or uses may only be made with the express written consent of the Commission.
9. This permit may be modified by the Commission and the amount of water initially granted to the permittee may be reduced if the Commission determines it is necessary to:
 - a. protect the water sources (quantity or quality);
 - b. meet other legal obligations including other correlative rights;

- c. insure adequate conservation measures;
- d. require efficiency of water uses;
- e. reserve water for future uses, provided that all legal existing uses of water as of June, 1987 shall be protected;
- f. meet legal obligations to the Department of Hawaiian Home Lands, if applicable; or
- g. carry out such other necessary and proper exercise of the State's and the Commission's police powers under law as may be required.

Prior to any reduction, the Commission shall give notice of its proposed action to the permittee and provide the permittee an opportunity to be heard.

- 10. An approved flowmeter(s) must be installed to measure monthly withdrawals and a monthly record of withdrawals, salinity, temperature, and pumping times must be kept and reported to the Commission on Water Resource Management on forms provided by the Commission on a monthly basis (attached).
- 11. This permit shall be subject to the Commission's periodic review of the **Malakole** Aquifer System's sustainable yield. The amount of water authorized by this permit may be reduced by the Commission if the sustainable yield of the **Malakole** Aquifer System, or relevant modified aquifer(s), is reduced.
- 12. A permit may be transferred, in whole or in part, from the permittee to another, if:
 - a. The conditions of use of the permit, including, but not limited to, place, quantity, and purpose of the use, remain the same; and
 - b. The Commission is informed of the transfer within ninety days.

Failure to inform the department of the transfer invalidates the transfer and constitutes a ground for revocation of the permit. A transfer which involves a change in any condition of the permit, including a change in use covered in HRS § 174C-57, is also invalid and constitutes a ground for revocation.

- 13. The use(s) authorized by law and by this permit do not constitute ownership rights.
- 14. The permittee shall request modification of the permit as necessary to comply with all applicable laws, rules, and ordinances which will affect the permittee's water use.
- 15. The permittee understands that under HRS § 174C-58(4), that partial or total nonuse, for reasons other than conservation, of the water allowed by this permit for a period of four (4) continuous years or more may result in a permanent revocation as to the amount of water not in use. The Commission and the permittee may enter into a written agreement that, for reasons satisfactory to the Commission, any period of nonuse may not apply towards the four-year period. Any period of nonuse which is caused by a declaration of water shortage pursuant to section HRS § 174C-62 shall not apply towards the four-year period of forfeiture.

16. The permittee shall prepare and submit a water shortage plan within 30 days of the issuance of this permit as required by HAR § 13-171-42(c). The permittee's water shortage plan shall identify what the permittee is willing to do should the Commission declare a water shortage in the **Malakole** Ground Water Management Area.
17. The water use permit shall be subject to the Commission's establishment of instream standards and policies relating to the Stream Protection and Management (SPAM) program, as well as legislative mandates to protect stream resources.
18. Special conditions in the attached cover transmittal letter are incorporated herein by reference.
19. The permittee understands that any willful violation of any of the above conditions or any provisions of HRS § 174C or HAR § 13-171 may result in the suspension or revocation of this permit.

WUP	Permittee	Well No.	Well Name	Allocation	Initial chlorides	Current chlorides
Wells labeled as non-salt water wells in database						
076	STATE DLNR DOWALD	1905-05	EWA CAPROCK	0.5	0	
163	KALAELOA PARTNERS, L.P.	1805-04	KALAELOA 1	3.168		
163	KALAELOA PARTNERS, L.P.	1805-05	KALAELOA 2			
163	KALAELOA PARTNERS, L.P.	1805-06	KALAELOA 3		0	
163	KALAELOA PARTNERS, L.P.	1805-07	KALAELOA 4		0	
163	KALAELOA PARTNERS, L.P.	1805-08	KALAELOA 5		0	
163	KALAELOA PARTNERS, L.P.	1805-09	KALAELOA 6		0	
163	KALAELOA PARTNERS, L.P.	1805-10	KALAELOA 7		0	
163	KALAELOA PARTNERS, L.P.	1805-11	KALAELOA 8		0	
163	KALAELOA PARTNERS, L.P.	1805-12	KALAELOA 9		0	
166	CHEVRON USA, INC.	1907-02	CHEVRON FIRE	0	0	
425	STATE DOT - HARBORS		BARBERS PT. HARBOR			
750	VIP SANITATION, INC.	1805-16	VIP SANITATION	0.003	194	
768	Tesoro Hawaii Corp.	1805-03	HIRI185FW-1	0		
768	Tesoro Hawaii Corp.	1805-17	TSO06FW-2		0	
768	Tesoro Hawaii Corp.	1805-18	TSO06FW-3		0	
863	Covanta Energy Corp.	1806-09	Backup H-Power		17,950	
863	Covanta Energy Corp.	1806-10	Primary H-Power	3.34	17,950	
			Total allocation	7.011		
Wells labeled as salt-water wells in database						
161	AES HAWAII INC.	1806-11	AES 1	13	20,500	
161	AES HAWAII INC.	1806-12	AES 2		17,100	
161	AES HAWAII INC.	1806-13	AES 3		19,300	
161	AES HAWAII INC.	1806-14	AES 4		19,700	
176	HAWAIIAN ELECTRIC CO., INC.	1806-15	HECO COOLING	14.4	19,700	
176	HAWAIIAN ELECTRIC CO.	1806-16	HECO COOLING		19,700	8000 to 13,700
176	HAWAIIAN ELECTRIC CO.	1806-17	HECO COOLING		19,700	
176	HAWAIIAN ELECTRIC CO.	1806-18	HECO COOLING		19,700	
451	CHEVRON PRODUCTS CO.	1807-01	P-2095	1.5	19,700	17,755 to 17,956
451	CHEVRON PRODUCTS CO.	1807-02	P-2095A		19,700	
452	CHEVRON PRODUCTS CO.	1807-03	P-5219	0.1	0	7847 to 9885
452	CHEVRON PRODUCTS CO.	1807-04	P-5219A		0	
453	CHEVRON PRODUCTS CO.	1806-20	P-6109	2	19,700	18,222 to 18,791
453	CHEVRON PRODUCTS CO.	1806-21	P-6109A		19,700	
810	Ko Olina Intangibles, LLC	1906-12	Ko Olina Saltwater	6.525	450	
			Total allocation	37.525		

EXHIBIT 2

Hawaii RP Grass.txt

IRRIGATION MANAGEMENT SYSTEM

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*****
* DRZI/DZN = (INITIAL) ROOT ZONE DEPTH IRRIGATED(INCHES)
* DRZT/DZX = (MAXIMUM) TOTAL ZONE DEPTH (INCHES)
* KC/AKC = CROP WATER USE COEFFICIENTS
* AWD/ALD = ALLOWABLE SOIL WATER DEPLETIONS
* ETO = POTENTIAL CROP EVAPOTRANSPIRATION (INCHES)
* KC = CROP COEFFICIENT
* ET = CROP EVAPOTRANSPIRATION (INCHES)
* G_RAIN = GROSS RAINFALL (INCHES)
* N_RAIN = NET RAINFALL (INCHES)
* RO = RUNOFF (INCHES)
* INT = INTERCEPTION (INCHES)
* ER = EFFECTIVE RAINFALL (INCHES)
* ER21 = EFFECTIVE RAINFALL USING SCS TR21 METHOD (INCHES)
* DR = DRAINAGE (INCHES)
* NIR = NET IRRIGATION REQUIREMENT (INCHES)
* GIR = GROSS IRRIGATION REQUIREMENT (INCHES)
* GAL_A = IRRIGATION REQUIREMENT (IN 1000 GALLON PER ACRE)
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TMK = 7.002822479341
LOCATION = Hawaii

CROP TYPE = ZOYSIA GRASS (PERENNIAL)

ROOT ZONE DEPTH IRRIGATED (INCHES) = 24.0
TOTAL CROP ROOT ZONE DEPTH (INCHES)= 48.0

	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
KC=	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ALDP=	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

IRRIGATION SEASON = 1-1 TO 12-31 LENGTH = 365 DAYS

IRRIGATION SYSTEM : TYPE = MULTIPLE SPRINKLER
DESIGN APPLICATION EFFICIENCY = 75 %
FRACTION OF SOIL SURFACE IRRIGATED = 100 %
FRACTION EXTRACTED FROM IRRIGATED ZONE = 70 %

NORMAL IRRIGATION: SOIL WILL BE IRRIGATED TO FIELD CAPACITY AT EACH IRRIGATION

CLIMATE DATA BASE: LOCATION = Kunia LENGTH = 10 YEARS (1994~2005)
NO. OF BLANK RAIN: 0 NO. OF BLANK ET: 0
NO. OF MISSING DAYS (FILLED WITH AVERAGE VALUES): 0
APPLIED RATIOS: 0.6783(RAIN), 1.1456(ET)

SCS CURVE NUMBER = 89
MAX LAI = 2.000

GROSS RAINFALL IS USED FOR SCS TR21 EFFECTIVE RAINFALL CALCULATION

SOIL : SERIES = Coral outcrop TEXTURE = BDRK
SOIL LAYER DEPTHS (INCHES) AND WATER CONTENTS
DEPTH(I)= 60
WCON(I) ENTERED= 0.00

DEPTH TO WATER TABLE ENTERED = 2.00

SEASONAL OR ANNUAL GROSS IRRIGATION REQUIREMENT (INCHES)

WATER BUDGET COMPONENTS												
NIR	GIR	GAL_A	G_RAIN	N_RAIN	ER	ER21	RO	INT	ETo	ET	DR	
55.4	73.8	2005.3	14.1	9.0	9.0	4.5	4.3	0.8	65.2	65.2	0.0	
GIR STATISTICS												
MEAN	MED.	CV	XMAX	XMIN	ZERO	RSQ	50%	80%	90%	95%		
73.8	75.3	0.10	81.5	62.5	0.00	0.93	74.2	81.2	84.3	86.7		
NIR STATISTICS												
MEAN	MED.	CV	XMAX	XMIN	ZERO	RSQ	50%	80%	90%	95%		
55.4	56.5	0.10	61.1	46.9	0.00	0.93	55.7	60.9	63.2	65.0		

Hawaii RP Grass.txt

MONTHLY GROSS IRRIGATION REQUIREMENT (INCHES)

WATER BUDGET COMPONENTS												
MO	NIR	GIR	GAL_A	G_RAIN	N_RAIN	ER	ER21	RO	INT	ETO	ET	DR
1	2.4	3.2	86.5	2.5	1.7	1.7	0.8	0.7	0.1	3.6	3.6	0.0
2	3.4	4.6	123.7	1.4	0.8	0.8	0.4	0.5	0.1	4.3	4.3	0.0
3	3.8	5.0	136.3	1.6	1.2	1.2	0.6	0.3	0.1	5.2	5.2	0.0
4	4.6	6.2	167.1	0.6	0.5	0.5	0.2	0.1	0.1	5.6	5.6	0.0
5	5.2	6.9	188.5	0.8	0.6	0.6	0.3	0.2	0.1	6.2	6.2	0.0
6	5.9	7.8	212.5	0.3	0.2	0.2	0.1	0.1	0.0	6.5	6.5	0.0
7	6.3	8.4	229.0	0.3	0.2	0.2	0.1	0.0	0.1	7.0	7.0	0.0
8	6.4	8.5	230.0	0.5	0.3	0.3	0.2	0.1	0.0	6.9	6.9	0.0
9	5.9	7.9	214.3	0.3	0.3	0.3	0.1	0.0	0.0	6.3	6.3	0.0
10	4.7	6.2	169.2	1.3	0.9	0.9	0.5	0.3	0.1	5.5	5.5	0.0
11	3.7	4.9	134.3	2.9	1.3	1.3	0.8	1.5	0.1	4.3	4.3	0.0
12	3.1	4.2	113.7	1.6	1.0	1.0	0.5	0.5	0.1	3.9	3.9	0.0

GIR STATISTICS												
MO	MEAN	MED.	CV	XMAX	XMIN	ZERO	RSQ	50%	80%	90%	95%	
1	3.2	3.1	0.29	4.3	1.7	0.00	0.96	3.2	4.1	4.6	4.8	
2	4.6	4.8	0.21	5.5	2.9	0.00	0.90	4.6	5.5	5.7	5.7	
3	5.0	5.0	0.28	7.1	2.5	0.00	0.98	5.1	6.4	6.9	6.9	
4	6.2	6.5	0.12	6.9	4.8	0.00	0.87	6.2	6.8	7.1	7.3	
5	6.9	6.4	0.21	9.7	5.3	0.00	0.85	6.9	8.2	8.2	8.2	
6	7.8	7.6	0.09	9.2	7.0	0.00	0.91	7.8	8.5	8.7	8.7	
7	8.4	8.6	0.09	9.3	6.7	0.00	0.96	8.6	9.1	9.3	9.3	
8	8.5	9.0	0.13	9.7	6.8	0.00	0.86	8.5	9.2	9.2	9.2	
9	7.9	7.9	0.13	9.5	6.3	0.00	0.97	7.9	8.4	8.4	8.4	
10	6.2	6.5	0.15	7.8	4.5	0.00	0.82	6.3	7.1	7.3	7.3	
11	4.9	4.8	0.32	8.0	2.1	0.00	0.92	5.0	5.8	5.8	5.8	
12	4.2	4.2	0.43	7.2	1.9	0.00	0.98	4.0	5.2	5.2	5.2	

BI-WEEKLY GROSS IRRIGATION REQUIREMENT (INCHES)

WATER BUDGET COMPONENTS												
I2W	NIR	GIR	GAL_A	G_RAIN	N_RAIN	ER	RO	INT	ETO	ET	DR	
1	1.3	1.7	46.8	1.0	0.5	0.5	0.4	0.0	1.6	1.6	0.0	
2	0.9	1.2	32.4	1.0	0.8	0.8	0.1	0.1	1.7	1.7	0.0	
3	1.4	1.9	50.5	0.8	0.6	0.6	0.2	0.0	1.9	1.9	0.0	
4	1.8	2.4	65.6	0.7	0.3	0.3	0.3	0.0	2.2	2.2	0.0	
5	1.6	2.2	59.3	1.0	0.7	0.7	0.3	0.0	2.2	2.2	0.0	
6	1.8	2.4	65.5	0.8	0.6	0.6	0.2	0.0	2.4	2.4	0.0	
7	1.7	2.3	61.2	0.4	0.3	0.3	0.0	0.0	2.3	2.3	0.0	
8	2.2	3.0	80.1	0.3	0.3	0.3	0.0	0.0	2.7	2.7	0.0	
9	2.5	3.3	90.3	0.3	0.2	0.2	0.0	0.0	2.8	2.8	0.0	
10	2.2	2.9	79.9	0.5	0.4	0.4	0.1	0.0	2.8	2.8	0.0	
11	2.5	3.3	90.2	0.1	0.1	0.1	0.0	0.0	2.8	2.8	0.0	
12	2.8	3.8	102.1	0.2	0.1	0.1	0.1	0.0	3.1	3.1	0.0	
13	2.7	3.6	97.9	0.2	0.1	0.1	0.0	0.0	3.0	3.0	0.0	
14	3.0	4.0	107.8	0.0	0.0	0.0	0.0	0.0	3.2	3.2	0.0	
15	2.8	3.7	101.7	0.2	0.1	0.1	0.0	0.0	3.1	3.1	0.0	
16	2.8	3.7	101.2	0.4	0.3	0.3	0.1	0.0	3.2	3.2	0.0	
17	2.9	3.8	104.3	0.2	0.1	0.1	0.1	0.0	3.1	3.1	0.0	
18	3.0	4.0	107.8	0.1	0.1	0.1	0.0	0.0	3.2	3.2	0.0	
19	2.7	3.5	96.3	0.2	0.2	0.2	0.0	0.0	2.9	2.9	0.0	
20	2.4	3.2	86.5	0.3	0.2	0.2	0.0	0.0	2.6	2.6	0.0	
21	2.3	3.0	81.5	0.8	0.5	0.5	0.2	0.0	2.6	2.6	0.0	
22	1.9	2.5	67.1	0.4	0.3	0.3	0.1	0.0	2.2	2.2	0.0	
23	1.8	2.4	66.0	2.1	0.8	0.8	1.3	0.0	2.1	2.1	0.0	
24	1.6	2.1	56.3	0.8	0.6	0.6	0.2	0.0	1.9	1.9	0.0	
25	1.5	2.0	54.8	0.6	0.3	0.3	0.2	0.0	1.8	1.8	0.0	
26	1.4	1.9	52.1	0.8	0.5	0.5	0.3	0.0	1.8	1.8	0.0	

GIR STATISTICS												
I2W	MEAN	MED.	CV	XMAX	XMIN	ZERO	RSQ	50%	80%	90%	95%	
1	1.7	1.7	0.48	3.1	0.7	0.00	0.96	1.6	2.1	2.1	2.1	
2	1.2	1.2	0.34	1.8	0.6	0.00	0.96	1.2	1.6	1.9	2.1	
3	1.9	2.0	0.33	2.7	0.9	0.00	0.95	1.8	2.5	2.6	2.6	
4	2.4	2.5	0.30	3.3	0.8	0.00	0.93	2.5	2.9	2.9	2.9	
5	2.2	2.2	0.33	3.6	1.1	0.00	0.93	2.2	2.9	3.0	3.0	
6	2.4	2.2	0.43	3.8	0.4	0.00	0.88	2.5	3.2	3.2	3.2	
7	2.3	2.2	0.33	3.1	0.7	0.00	0.89	2.3	2.9	3.1	3.1	
8	3.0	2.8	0.16	3.6	2.4	0.00	0.89	2.9	3.4	3.6	3.7	
9	3.3	3.2	0.17	4.7	2.7	0.00	0.80	3.3	3.7	3.7	3.7	
10	2.9	2.8	0.31	4.4	1.5	0.00	0.96	2.9	3.8	3.8	3.8	

Hawaii RP Grass.txt											
11	3.3	3.2	0.18	4.2	2.2	0.00	0.92	3.4	3.7	3.7	3.7
12	3.8	3.8	0.13	4.4	3.0	0.00	0.92	3.8	4.1	4.1	4.1
13	3.6	3.5	0.11	4.2	3.1	0.00	0.93	3.6	4.0	4.1	4.1
14	4.0	4.0	0.12	4.9	3.1	0.00	0.88	4.0	4.3	4.3	4.3
15	3.7	3.7	0.16	4.6	2.9	0.00	0.96	3.8	4.2	4.2	4.2
16	3.7	3.8	0.17	4.7	2.6	0.00	0.85	3.8	4.2	4.2	4.2
17	3.8	4.1	0.15	4.3	2.7	0.00	0.74	3.9	4.1	4.1	4.1
18	4.0	4.0	0.12	4.7	3.2	0.00	0.96	4.0	4.2	4.2	4.2
19	3.5	3.5	0.17	4.3	2.3	0.00	0.94	3.6	3.8	3.8	3.8
20	3.2	3.3	0.19	4.0	2.2	0.00	0.97	3.2	3.5	3.5	3.5
21	3.0	3.0	0.28	4.0	1.5	0.00	0.95	3.0	3.5	3.5	3.5
22	2.5	2.4	0.23	3.4	1.4	0.00	0.96	2.5	3.0	3.0	3.0
23	2.4	2.5	0.38	3.8	0.3	0.00	0.92	2.6	2.8	2.8	2.8
24	2.1	1.8	0.48	4.5	1.0	0.00	0.89	2.0	2.5	2.5	2.5
25	2.0	2.0	0.43	3.6	0.9	0.00	0.97	1.9	2.4	2.4	2.4
26	1.9	2.1	0.48	3.0	0.5	0.00	0.89	1.8	2.4	2.4	2.4

WEEKLY GROSS IRRIGATION REQUIREMENT (INCHES)

WATER BUDGET COMPONENTS											
WK	NIR	GIR	GAL_A	G_RAIN	N_RAIN	ER	RO	INT	ETo	ET	DR
1	0.6	0.9	23.3	0.8	0.4	0.4	0.4	0.0	0.7	0.7	0.0
2	0.6	0.9	23.5	0.2	0.1	0.1	0.0	0.0	0.8	0.8	0.0
3	0.4	0.6	15.3	0.6	0.5	0.5	0.1	0.0	0.8	0.9	0.0
4	0.5	0.6	17.1	0.3	0.3	0.3	0.0	0.0	0.8	0.8	0.0
5	0.6	0.9	23.1	0.7	0.4	0.4	0.2	0.0	0.9	0.9	0.0
6	0.8	1.0	27.4	0.1	0.1	0.1	0.0	0.0	1.0	1.0	0.0
7	0.9	1.1	30.9	0.6	0.3	0.3	0.3	0.0	1.0	1.1	0.0
8	1.0	1.3	34.7	0.1	0.0	0.0	0.0	0.0	1.1	1.1	0.0
9	1.0	1.3	35.1	0.6	0.3	0.3	0.3	0.0	1.2	1.2	0.0
10	0.7	0.9	24.1	0.4	0.3	0.3	0.1	0.0	1.1	1.1	0.0
11	0.9	1.1	31.1	0.4	0.3	0.3	0.0	0.0	1.2	1.2	0.0
12	0.9	1.3	34.4	0.4	0.3	0.3	0.1	0.0	1.2	1.2	0.0
13	0.8	1.1	30.4	0.2	0.2	0.2	0.0	0.0	1.2	1.2	0.0
14	0.9	1.1	30.9	0.2	0.2	0.2	0.0	0.0	1.1	1.1	0.0
15	1.1	1.5	40.4	0.1	0.1	0.1	0.0	0.0	1.4	1.4	0.0
16	1.1	1.5	39.7	0.2	0.2	0.2	0.0	0.0	1.4	1.4	0.0
17	1.3	1.7	45.6	0.0	0.0	0.0	0.0	0.0	1.4	1.4	0.0
18	1.2	1.6	44.8	0.2	0.2	0.2	0.0	0.0	1.4	1.4	0.0
19	1.1	1.4	38.5	0.2	0.2	0.2	0.0	0.0	1.4	1.4	0.0
20	1.1	1.5	41.4	0.3	0.2	0.2	0.1	0.0	1.4	1.4	0.0
21	1.2	1.6	43.1	0.1	0.0	0.0	0.0	0.0	1.4	1.4	0.0
22	1.3	1.7	47.1	0.0	0.0	0.0	0.0	0.0	1.4	1.4	0.0
23	1.4	1.8	49.5	0.1	0.1	0.1	0.1	0.0	1.5	1.5	0.0
24	1.5	1.9	52.6	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0
25	1.4	1.8	49.6	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0
26	1.3	1.8	48.3	0.1	0.1	0.1	0.0	0.0	1.5	1.5	0.0
27	1.5	2.0	54.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0
28	1.5	2.0	53.8	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0
29	1.4	1.9	50.4	0.1	0.1	0.1	0.0	0.0	1.6	1.6	0.0
30	1.4	1.9	51.2	0.1	0.1	0.1	0.0	0.0	1.6	1.6	0.0
31	1.4	1.8	49.3	0.3	0.2	0.2	0.1	0.0	1.6	1.6	0.0
32	1.4	1.9	51.9	0.1	0.1	0.1	0.0	0.0	1.6	1.6	0.0
33	1.5	2.0	54.2	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0
34	1.4	1.8	50.2	0.2	0.1	0.1	0.1	0.0	1.5	1.5	0.0
35	1.4	1.9	51.5	0.1	0.0	0.0	0.0	0.0	1.5	1.5	0.0
36	1.6	2.1	56.3	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0
37	1.4	1.9	50.7	0.1	0.1	0.1	0.0	0.0	1.5	1.5	0.0
38	1.3	1.7	45.6	0.1	0.1	0.1	0.0	0.0	1.3	1.3	0.0
39	1.3	1.7	47.2	0.1	0.1	0.1	0.0	0.0	1.4	1.4	0.0
40	1.1	1.4	39.3	0.2	0.1	0.1	0.0	0.0	1.2	1.2	0.0
41	1.3	1.7	47.1	0.3	0.2	0.2	0.1	0.0	1.4	1.4	0.0
42	0.9	1.3	34.4	0.4	0.3	0.3	0.1	0.0	1.2	1.2	0.0
43	1.0	1.3	34.6	0.2	0.1	0.1	0.0	0.0	1.2	1.2	0.0
44	0.9	1.2	32.6	0.3	0.2	0.2	0.1	0.0	1.1	1.1	0.0
45	0.9	1.2	33.2	1.1	0.3	0.3	0.8	0.0	1.1	1.1	0.0
46	0.9	1.2	32.8	1.0	0.4	0.4	0.6	0.0	1.0	1.0	0.0
47	0.8	1.1	29.6	0.1	0.1	0.1	0.0	0.0	1.0	1.0	0.0
48	0.7	1.0	26.8	0.7	0.5	0.5	0.2	0.0	0.9	0.9	0.0
49	0.7	1.0	26.7	0.4	0.2	0.2	0.2	0.0	0.9	0.9	0.0
50	0.8	1.0	28.1	0.2	0.2	0.2	0.0	0.0	0.9	0.9	0.0
51	0.8	1.0	27.2	0.2	0.1	0.1	0.0	0.0	0.9	0.9	0.0
52	0.7	0.9	24.9	0.6	0.4	0.4	0.2	0.0	0.9	0.9	0.0

GIR STATISTICS											
WK	MEAN	MED.	CV	XMAX	XMIN	ZERO	RSQ	50%	80%	90%	95%
1	0.9	0.8	0.61	1.7	0.2	0.00	0.96	0.8	1.0	1.0	1.0

Hawaii RP Grass.txt											
2	0.9	1.0	0.40	1.3	0.3	0.00	0.92	0.9	1.1	1.1	1.1
3	0.6	0.6	0.47	1.0	0.2	0.00	0.98	0.5	0.8	1.0	1.1
4	0.6	0.6	0.42	1.1	0.3	0.00	0.98	0.6	0.9	1.1	1.1
5	0.9	1.0	0.39	1.3	0.2	0.00	0.87	0.9	1.2	1.2	1.2
6	1.0	1.1	0.36	1.5	0.6	0.00	0.94	1.0	1.4	1.4	1.4
7	1.1	1.2	0.39	1.7	0.2	0.00	0.81	1.2	1.4	1.4	1.4
8	1.3	1.2	0.33	1.8	0.6	0.00	0.88	1.3	1.5	1.5	1.5
9	1.3	1.4	0.45	1.9	0.1	0.00	0.84	1.3	1.6	1.6	1.6
10	0.9	0.7	0.46	1.6	0.4	0.00	0.95	0.8	1.3	1.4	1.4
11	1.1	1.3	0.52	1.8	0.0	0.00	0.85	1.1	1.6	1.6	1.6
12	1.3	1.2	0.46	2.2	0.4	0.00	0.97	1.2	1.6	1.6	1.6
13	1.1	1.2	0.35	1.8	0.5	0.00	0.95	1.1	1.5	1.6	1.6
14	1.1	1.2	0.37	1.7	0.2	0.00	0.95	1.2	1.5	1.5	1.5
15	1.5	1.5	0.26	2.3	1.1	0.00	0.92	1.5	1.8	1.8	1.8
16	1.5	1.4	0.27	2.1	0.8	0.00	0.96	1.5	1.8	1.8	1.8
17	1.7	1.7	0.23	2.5	1.1	0.00	0.92	1.7	1.9	1.9	1.9
18	1.6	1.6	0.18	2.2	1.3	0.00	0.92	1.6	1.8	1.8	1.8
19	1.4	1.5	0.34	2.1	0.7	0.00	0.95	1.4	1.9	1.9	1.9
20	1.5	1.6	0.39	2.4	0.4	0.00	0.82	1.5	1.9	1.9	1.9
21	1.6	1.5	0.26	2.2	1.0	0.00	0.92	1.6	1.8	1.8	1.8
22	1.7	1.9	0.20	2.0	1.0	0.00	0.87	1.8	1.9	1.9	1.9
23	1.8	1.8	0.18	2.3	1.2	0.00	0.96	1.8	2.0	2.0	2.0
24	1.9	1.9	0.10	2.2	1.6	0.00	0.97	2.0	2.1	2.1	2.1
25	1.8	1.9	0.13	2.1	1.4	0.00	0.98	1.8	2.0	2.0	2.0
26	1.8	1.8	0.18	2.3	1.3	0.00	0.97	1.8	2.0	2.0	2.0
27	2.0	2.0	0.12	2.4	1.5	0.00	0.89	2.0	2.2	2.2	2.2
28	2.0	2.0	0.14	2.5	1.6	0.00	0.97	2.0	2.1	2.1	2.1
29	1.9	2.0	0.21	2.3	1.1	0.00	0.94	1.9	2.1	2.1	2.1
30	1.9	1.8	0.21	2.4	1.3	0.00	0.92	1.9	2.1	2.1	2.1
31	1.8	1.8	0.14	2.3	1.6	0.00	0.94	1.8	2.1	2.1	2.1
32	1.9	2.1	0.24	2.4	1.1	0.00	0.82	1.9	2.1	2.1	2.1
33	2.0	2.1	0.17	2.3	1.2	0.00	0.96	2.1	2.1	2.1	2.1
34	1.8	1.9	0.19	2.2	1.2	0.00	0.91	1.9	2.0	2.0	2.0
35	1.9	2.0	0.15	2.1	1.2	0.00	0.90	2.0	2.0	2.0	2.0
36	2.1	2.0	0.17	2.6	1.4	0.00	0.90	2.1	2.2	2.2	2.2
37	1.9	2.0	0.18	2.3	1.3	0.00	0.96	1.9	2.0	2.0	2.0
38	1.7	1.7	0.23	2.0	0.8	0.00	0.88	1.7	1.8	1.8	1.8
39	1.7	1.9	0.22	2.2	1.0	0.00	0.87	1.8	1.9	1.9	1.9
40	1.4	1.5	0.28	2.1	0.9	0.00	0.97	1.4	1.6	1.6	1.6
41	1.7	1.9	0.29	2.2	0.4	0.00	0.93	1.9	1.9	1.9	1.9
42	1.3	1.2	0.40	1.9	0.4	0.00	0.96	1.3	1.5	1.5	1.5
43	1.3	1.3	0.31	1.8	0.6	0.00	0.96	1.3	1.6	1.6	1.6
44	1.2	1.3	0.32	1.7	0.6	0.00	0.90	1.2	1.4	1.4	1.4
45	1.2	1.3	0.45	2.0	0.1	0.00	0.93	1.2	1.5	1.5	1.5
46	1.2	1.3	0.36	1.8	0.1	0.00	0.96	1.3	1.4	1.4	1.4
47	1.1	1.1	0.40	2.0	0.5	0.00	0.89	1.1	1.3	1.3	1.3
48	1.0	0.8	0.62	2.5	0.4	0.00	0.90	0.9	1.3	1.3	1.3
49	1.0	0.9	0.44	1.5	0.1	0.00	0.92	1.0	1.3	1.3	1.3
50	1.0	1.0	0.58	2.2	0.2	0.00	0.85	0.9	1.2	1.2	1.2
51	1.0	1.1	0.37	1.4	0.4	0.00	0.87	1.0	1.2	1.2	1.2
52	0.9	0.9	0.63	1.6	0.0	0.00	0.93	0.8	1.2	1.2	1.2

 * SUMMARY *

 TMK : 7.002822479341
 SOILS: coral outcrop(1.000)

ANNUAL IRRIGATION REQUIREMENT (INCHES)

WATER BUDGET COMPONENTS												
	NIR	GIR	GAL_A	G_RAIN	N_RAIN	ER	ER21	RO	INT	ETo	ET	DR
	55.4	73.8	2005.3	14.1	9.0	9.0	4.5	4.3	0.8	65.2	65.2	0.0
GIR STATISTICS												
ACRES	UNIT	MEAN	MED.			XMAX	XMIN		50%	80%	90%	95%
	inch/acre	73.848	75.307			81.482	62.500		74.241	81.159	84.291	86.670
	Thou. gpd/acre	5.494	5.602			6.062	4.650		5.523	6.038	6.271	6.448
7.00	Total thou. gpd	38.473	39.233			42.450	32.561		38.678	42.282	43.914	45.153
NIR STATISTICS												
ACRES	UNIT	MEAN	MED.			XMAX	XMIN		50%	80%	90%	95%
	inch/acre	55.386	56.480			61.112	46.875		55.681	60.869	63.219	65.003
	Thou. gpd/acre	4.120	4.202			4.546	3.487		4.142	4.528	4.703	4.836
7.00	Total thou. gpd	28.855	29.425			31.838	24.421		29.008	31.711	32.935	33.865

Note:- Irrigated area for the selected MULTIPLE SPRINKLER irrigation system is 1.0 of the total area

Hawaii RP Grass.txt

MONTHLY IRRIGATION REQUIREMENT (INCHES)

WATER BUDGET COMPONENTS												
MO	NIR	GIR	GAL_A	G_RAIN	N_RAIN	ER	ER21	RO	INT	ETo	ET	DR
1	2.4	3.2	86.5	2.5	1.7	1.7	0.8	0.7	0.1	3.6	3.6	0.0
2	3.4	4.6	123.7	1.4	0.8	0.8	0.4	0.5	0.1	4.3	4.3	0.0
3	3.8	5.0	136.3	1.6	1.2	1.2	0.6	0.3	0.1	5.2	5.2	0.0
4	4.6	6.2	167.1	0.6	0.5	0.5	0.2	0.1	0.1	5.6	5.6	0.0
5	5.2	6.9	188.5	0.8	0.6	0.6	0.3	0.2	0.1	6.2	6.2	0.0
6	5.9	7.8	212.5	0.3	0.2	0.2	0.1	0.1	0.0	6.5	6.5	0.0
7	6.3	8.4	229.0	0.3	0.2	0.2	0.1	0.0	0.1	7.0	7.0	0.0
8	6.4	8.5	230.0	0.5	0.3	0.3	0.2	0.1	0.0	6.9	6.9	0.0
9	5.9	7.9	214.3	0.3	0.3	0.3	0.1	0.0	0.0	6.3	6.3	0.0
10	4.7	6.2	169.2	1.3	0.9	0.9	0.5	0.3	0.1	5.5	5.5	0.0
11	3.7	4.9	134.3	2.9	1.3	1.3	0.8	1.5	0.1	4.3	4.3	0.0
12	3.1	4.2	113.7	1.6	1.0	1.0	0.5	0.5	0.1	3.9	3.9	0.0

GIR STATISTICS								
MO	MEAN	MED.	XMAX	XMIN	50%	80%	90%	95%
1	3.2	3.1	4.3	1.7	3.2	4.1	4.6	4.8
2	4.6	4.8	5.5	2.9	4.6	5.5	5.7	5.7
3	5.0	5.0	7.1	2.5	5.1	6.4	6.9	6.9
4	6.2	6.5	6.9	4.8	6.2	6.8	7.1	7.3
5	6.9	6.4	9.7	5.3	6.9	8.2	8.2	8.2
6	7.8	7.6	9.2	7.0	7.8	8.5	8.7	8.7
7	8.4	8.6	9.3	6.7	8.6	9.1	9.3	9.3
8	8.5	9.0	9.7	6.8	8.5	9.2	9.2	9.2
9	7.9	7.9	9.5	6.3	7.9	8.4	8.4	8.4
10	6.2	6.5	7.8	4.5	6.3	7.1	7.3	7.3
11	4.9	4.8	8.0	2.1	5.0	5.8	5.8	5.8
12	4.2	4.2	7.2	1.9	4.0	5.2	5.2	5.2